

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of

Mitigation of Orbital Debris

IB Docket No. 02-54

**COMMENTS OF THE
SATELLITE INDUSTRY ASSOCIATION**

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SUMMARY

The Commission should adopt minimal regulation of orbital debris because the self-interest of satellite operators leads them to practice orbital debris mitigation techniques in every phase of a satellite's life. Satellite operators are self-motivated to build and operate spacecraft that will not be damaged or fail in-orbit, in order to preserve their essential (and very costly) operating assets. In addition, satellite operators have a commercial interest in relocating their spacecraft to safe orbits at end-of-life in order to maintain the value of those orbits for replacement satellites.

The Commission has not identified a problem that requires regulation. Historically, no U.S.-licensed satellites have suffered collisions or caused orbital debris. Furthermore, it is not clear that the Commission could formulate useful debris mitigation rules because of the technical nature of satellite design and the trade-offs necessary to meet mission requirements.

It is not necessary to require certification of orbital debris plans at any phase of a satellite's life or as part of space station application requirements. If the Commission determines to adopt end-of-life guidelines, however, it should do so only prospectively and should provide operators of geostationary satellites with the flexibility of choosing between the lesser of the orbit achieved through application of the IADC formula and 300 kilometers. For non-geostationary satellites, the Commission should continue its case-by-case review of de-orbiting plans.

The Commission should not mandate insurance coverage for satellites. There has never been a problem caused by on-orbit satellites or satellites that have been de-orbited. In the absence of a problem, there is no reason to impose additional costs on operators.

The Commission should apply whatever rules it adopts with respect to debris mitigation to satellite operators wishing to serve the U.S. market through non-U.S. licensed satellites. This is consistent with the policy adopted in *DISCO II*, which was designed to create a level playing field among operators.

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The Satellite Industry Association (“SIA”)¹ hereby submits these comments pursuant to section 1.415 of the Commission’s rules,² and in response to the Federal Communications Commission’s (“FCC” or “Commission”) request for comments in the above referenced proceeding.

I. INTRODUCTION

SIA is a national trade association representing the leading U.S. satellite manufacturers, service providers, and launch service companies. SIA also recently began welcoming non-U.S. companies as associate members. SIA’s members provide a broad range of products and services in the commercial satellite industry. Members include the

¹ SIA’s members include: The Boeing Company; Globalstar, L.P.; Hughes Electronics Corp.; Intelsat LLC; Lockheed Martin Corp.; Loral Space & Communications Ltd.; Mobile Satellite Ventures; PanAmSat Corporation; SES Americom, Inc.; Teledesic Corporation; TRW Inc., ICO Global Communications and associate member, Inmarsat LLC.

² 47 C.F.R. §1.415.

recognized founders of commercial satellite communications, along with aspiring entrepreneurial companies seeking to provide new competitive services to consumers.

SIA serves as an advocate for the commercial satellite industry on regulatory and policy issues. SIA's diverse membership permits the association to present a unified voice of the U.S. commercial satellite industry. SIA is therefore uniquely qualified to provide to the Commission the satellite industry's consensus position on the important matters raised in this proceeding.

II. The Commission Should Minimize Regulation of Orbital Debris

SIA welcomes this opportunity to comment on an issue of critical importance to its members. As manufacturers and operators of spacecraft, SIA members are vitally interested in minimizing any risks of spacecraft collision. SIA members are driven by economic and operational self-interest to design and operate their spacecraft for longevity and reliability and to relocate spacecraft to safe graveyard orbits.

Inadequate collision or debris mitigation measures raise the collision risks to the satellite operators' existing and future spacecraft and threaten the future commercial viability of the operators. Operators cannot ignore debris mitigation in favor of profit maximization at any stage in a satellite's life. Thus, satellite operators are self-motivated to build and operate spacecraft that will not be damaged or fail in-orbit, in order to preserve their essential (and very costly) operating assets. In addition, satellite operators have a commercial interest in relocating their spacecraft to safe orbits at end-of-life. This

keeps their assigned orbits free of debris so they can exercise their “replacement expectancy”³ and continue to safely use their assigned orbital locations.

The strength of this economic incentive throughout mission life – and the success of self-regulation -- is demonstrated by the fact that to date no FCC-licensed commercial satellite has exploded once launched into space and none have suffered a collision in space.⁴ In light of the successful self-regulation exercised by the U.S. satellite industry, SIA believes that minimal regulation is required by the Commission.⁵

The Commission is proposing to adopt various requirements to minimize what is already a very, very small risk that commercial satellites will become orbital debris that poses a risk to other spacecraft. As discussed below, it is not clear that some of the proposed changes would actually accomplish the Commission’s objective. At the same time, new regulatory requirements would impose real and quantifiable costs on commercial satellite operators. The Commission must weigh the actual costs of its proposed changes against the potential added level of protection that will be achieved for

³ The replacement expectancy doctrine provides that an application for a replacement satellite generally will be granted so long as the applicant remains legally, technically, and financially qualified to operate its proposed satellite; in the ordinary case, these statutory qualifications are assumed to be fulfilled. See, e.g., Licensing Space Stations in the Domestic Fixed-Satellite Service, Memorandum Opinion and Order], 50 Fed. Reg. 36071, ¶¶ 26-28 (1985); Assignment of Orbital Locations to Space Stations in the Domestic Fixed-Satellite Service, Report and Order, 3 F.C.C. Rcd. 6972, n.31 (1988).

⁴ The *NPRM* cites only one instance of a collision of a commercial space station and that was not with another commercial space station but with a piece of an exploded Ariane upper stage rocket. See *NPRM* at n. 96.

⁵ The Commission also asks whether insolvency affects an operator’s self-interest – or that of the trustee in bankruptcy – in utilizing debris mitigation measures. SIA believes that even in insolvency the need to protect the company’s assets and limit its liability would promote debris mitigation measures.

the country's orbital assets. The Commission should not impose regulations, and the resulting costs on the satellite industry, if the regulations are not certain to achieve the intended purpose or if the costs outweigh the identified benefits.

Furthermore, in weighing the costs of regulation, the Commission should keep in mind that there is fierce competition in today communication's market. Operators of U.S.-licensed satellites must compete with operators of non-U.S. licensed satellites, which may be subject to different rules, as well as with terrestrial providers of similar services. The Commission should avoid taking any action that would increase satellite design, construction or operation costs, thereby reducing the ability of U.S. licensed satellite operators to compete in the U.S. and global market and potentially increasing some costs to the U.S. consumer. The Commission has previously recognized that satellite design is best left to the operator.⁶

In fashioning the regulatory scheme, it is important to distinguish between geostationary and non-geostationary satellites. The operational environment for each is different and the rules should reflect those differences. The *NPRM* recognizes some of these differences.⁷ In the area of orbital debris mitigation, "one-size" does not fit all situations and the Commission should carefully tailor any regulations as narrowly as possible.

⁶ See, e.g., Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile-Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands, *Notice of Proposed Rulemaking*, 9 FCC Rcd 1094, 1100-01 (1994).

⁷ See e.g., *NPRM* at ¶ 38.

Finally, the Commission should keep in mind its determination to streamline the satellite licensing process⁸ and its statutory mandate to eliminate unnecessary regulatory requirements.⁹ One of the objectives of the *Satellite Licensing Reform NPRM* is to “significantly reduce administrative burdens on applicants.”¹⁰ This principle should also apply to licensees. Absent concrete benefits from certifications, application filing requirements or other regulations, the Commission should refrain from imposing additional regulatory burdens.

III. Satellite Operators Practice Self-Regulation, which is Sufficient Protection Against Orbital Debris

The Commission proposes to require disclosure of orbital debris mitigation plans as part of the licensing process and to mandate certain operating procedures during the life of a satellite.¹¹ As shown below, U.S. licensed operators already practice debris mitigation in all stages of a satellite’s mission and little Commission action is required.

A. Control of Orbital Debris During Normal Operations

The Commission first addresses the control of debris released during normal operations.¹² SIA confirms that U.S. licensed commercial communications spacecraft do

⁸ See, e.g., Amendment of the Commission’s Space Station Licensing Rules and Policies, *Notice of Proposed Rulemaking and First Report and Order*, FCC 02-45 (2002) (“*Satellite Licensing Reform NPRM*”).

⁹ 47 U.S.C. § 161 (directing the Commission to undertake biennial reviews to repeal or modify any regulation it determines to be “no longer necessary in the public interest”).

¹⁰ *Satellite Licensing Reform NPRM* at 1.

¹¹ *NPRM* at ¶ 28.

¹² *Id.* at ¶ 36-7.

not release orbital debris following the launch phase of operation.¹³ Upon the successful separation of the spacecraft from the launch vehicle and deployment, the spacecraft stays in one piece. In the absence of a catastrophic event, such as a collision with a man-made object or meteor, the spacecraft will remain in one piece through its useful life and the deorbiting process.

Typically, satellite operators and manufacturers do an assessment of a satellite's vulnerability in a collision with man-made objects or meteors. Such vulnerability affects the decisions, as the Commission notes,¹⁴ on spacecraft shielding, placement of components and use of redundant systems to maintain satellite control, thus ensuring post-mission disposal capability.

Requiring a licensee to certify as part of its application that it has assessed the probability a spacecraft would become a source of orbital debris through collision does not seem very useful. It is unrealistic for the Commission to regulate spacecraft design or set parameters for the scope of any assessment. For example, on what bases would the Commission determine the size of the satellite or materials used in its construction or the type and level of redundancy? Clearly, no amount of redundancy or shielding can eliminate the risk associated with in-orbit collisions. As a result, satellite operators must trade off redundancy and shielding with concerns about weight and cost and other mission requirements. The Commission does not have the expertise or the operator's insight necessary to perform that trade-off analysis. In addition, the Commission and the

¹³ SIA is not addressing the issue of orbital debris resulting from the launch vehicle. These comments are limited to orbital debris issues arising from the separation of the satellite from the launch vehicle, the deployment of the satellite's antennas and solar arrays and the satellite's operation thereafter.

¹⁴ *NPRM* at ¶ 37.

satellite operators cannot predict or quantify at the time a satellite system is first planned and launched, what man-made objects or meteors would be in orbit or what type of technology would be available to assist in collision avoidance during the estimated 15-20 year life of a spacecraft.

If the Commission cannot establish clear parameters for the vulnerability assessment, each manufacturer and operator would apply its own standard (as they do now). As a result, any certification would lack meaning and might not serve its intended purpose. In reality, the certification would become just an “administrative burden” on a licensee.

Another reason for the Commission to avoid defining the scope of any vulnerability assessment is the Commission’s traditional approach of leaving design issues to the operator.¹⁵ Any attempt by the Commission to mandate spacecraft design could increase the cost of satellite design, construction and launch. Such costs would get passed on to consumers. Any increased costs to consumers would reduce the competitiveness of satellite services relative to terrestrial services and therefore diminish the benefit of price-competitive quality communications services to the consumer. Moreover, any increased costs would negatively impact the ability of U.S. licensed operators to compete with foreign operators in the United States and internationally, if those non-U.S. licensees are not subject to the same criteria.

Additional questions arise if the Commission mandates a vulnerability assessment. For example, how would the Commission determine if the applicant adequately complied with the assessment requirement, particularly if a satellite is later

¹⁵ See, fn. 5.

involved in a collision with a man-made object or meteor? What if that object was not a risk at the time of the assessment? Would the operator be subject to a penalty or liability for not carrying out an adequate vulnerability assessment? A requirement for certification of a vulnerability assessment raises more questions than answers. The objective of such an assessment would be to limit the probability that operating spacecraft will become a source of orbital debris. But as shown, mandating that a vulnerability assessment occur and what its scope should be is unlikely to achieve that objective. Such a requirement would offer no identifiable benefit and should not be adopted.

Clearly, it is in the operators' commercial interest to launch and operate spacecraft in a manner that minimizes the risk of collision. It is also in the operators' interest to undertake their best efforts to prevent their spacecraft from becoming a source of orbital debris that might result in future danger or harm to their own or other spacecraft. Thus, the Commission should continue to rely on the existing (and successful) self-assessment process as well as on the fact that every operator has a commercial interest in building a robust spacecraft that will survive for 15 to 20 years after which that satellite would be replaced by the same operator.

B. Minimizing Debris Generated by Accidental Explosions

The Commission notes that assessing and limiting the probability of accidental explosion during and after completion of mission operations is the "single most important debris mitigation measure regarding potential damage to space assets."¹⁶ SIA agrees but also wishes to point out that once a spacecraft is in orbit and in the absence of a collision

¹⁶ *NPRM* at ¶ 39.

with a man-made object or meteor, there is virtually no chance of the spacecraft exploding. In fact, it has never happened. Again, in the absence of an identifiable problem, the Commission should not impose an “administrative burden” on applicants.

During design review, the satellite manufacturer conducts a failure mode verification analysis (“FMVA”) to review potential problems, including possible explosion scenarios. The design of the satellite is assessed in light of those scenarios, as well as in light of competing concerns, such as satellite weight and cost. The FMVA varies by manufacturer and there is no standard or uniform industry process. Satellite operators and manufacturers treat the FMVA as business confidential information.

SIA believes that the Commission should continue to rely on the commercial interests of the satellite operator to keep its satellites operational after launch, rather than mandate the scope of any form of FMVA or require any form of certification. The Commission should not look to Federal Aviation Administration regulation of launch vehicles as precedent for regulating space stations. The purpose of a launch vehicle is completely different from the long-term operation of a satellite, as are the economic incentives at work. Moreover, there has never been an explosion of a U.S.-licensed on-orbit satellite. Given that it is already industry practice to perform an assessment of accidental explosion as part of the FMVA, and in the absence of any evidence of a problem, the Commission should avoid superfluous regulation.

Similarly, the Commission should not mandate any particular fuel level at the time of de-orbit or require any reports concerning fuel availability at end-of-life. First, it is in an operator’s commercial interest to maintain sufficient fuel to de-orbit its spacecraft at the end-of-life to a safe (*i.e.* sufficiently separated) and stable storage orbit so that a

new generation replacement satellite can be safely operated in the same orbital location. Second, as noted above, the Commission does not and should not get involved in design review. Third, it is not clear how the Commission would decide what is an adequate amount of fuel given that every spacecraft is different and fuel determination is not an exact science. The Commission would need to determine an exact de-orbit fuel quantity for every licensed satellite.

C. Safe Flight Profiles

1. Application Filing Requirements.

The Commission seeks comment on whether the information typically provided in an application is sufficient to enable operators to evaluate the potential for collisions and safe-flight profiles.¹⁷ SIA members are satisfied that the information currently provided as part of the application process is sufficient to do the job. More importantly, the streamlined information proposed by SIA in its comment on the *Satellite Licensing Reform NPRM*¹⁸ will provide sufficient information to allow operators to protect their satellites from collision and adopt safe-flight plans.

2. Rules and Practices for Pre-Operational Phase.

SIA agrees that the Commission should continue its existing practice of addressing the deployment and testing phase of satellite operations on a case-by-case basis.¹⁹ A licensee should have the flexibility of including its deployment and testing

¹⁷ *Id.* at ¶ 44.

¹⁸ Comments of Satellite Industry Association at 37-39.

¹⁹ *NPRM* at ¶ 45.

plans in the original application or through a request when the time for launch approaches for special temporary authority.

The Commission seeks comment on the level of “specificity of disclosure” that should be required in connection with pre-operation maneuvers.²⁰ SIA does not believe the Commission needs to collect any additional information about the deployment and testing phase than it currently requires. The underlying application contains technical information about the satellite. Commission rules already require an applicant to notify the Commission of any changes to the information in an application.²¹ In addition, any changes, such as the temporary orbital location, would be included in a STA request.

3. On-Orbit Operations.

SIA supports most of the suggestions made by the Commission regarding on-orbit operations. It is useful to provide an explicit exception to the 0.05° rule for satellites being de-orbited. It is already industry practice to maintain geostationary (“GEO”) satellites within 0.05° of their assigned orbital longitude, unless otherwise authorized by the Commission. Finally, the proposed modification to the rule regarding operation in inclined orbit is a welcome clarification of the notification obligation.

With respect to non-geostationary satellites (“NGSOs”) systems, the Commission tentatively concludes that applicants should disclose in their license application the tolerances within which orbital parameters would be maintained so that potentially affected third parties could evaluate any collision risk.²² Furthermore, the Commission

²⁰ *Id.* at ¶ 46.

²¹ *See* 47 C.F.R. §§ 25.117 and 118.

²² *See NPRM* at ¶ 49.

seeks comment on whether it is appropriate to specify a required tolerance within which orbital parameters for NGSOs must be established; or, alternatively, whether tolerances should be addressed on a case-by-case basis.²³ SIA believes that it would be appropriate for NGSO satellite applicants to include in their applications the tolerances within which their system would be capable of maintaining the orbital parameters listed in their license application. However, SIA urges the Commission not to require any specific tolerance levels. The International Telecommunication Union Radio Regulations do not specify any mandatory tolerances for NGSO satellites within which orbital parameters must be maintained. In the case of NGSOs, there is generally a large separation between satellites, because there are more parameters to work with (*e.g.*, orbital altitude and resulting period, inclination), instead of just the one dimension of angular separation (longitude) on the equatorial, geostationary arc. Therefore, there is really no need to require specific tolerances on the orbital elements for NGSOs.

SIA agrees with the Commission that orbital parameters for a particular system should be left to the operator.²⁴ As part of their due diligence prior to seeking a license or launching a satellite, operators evaluate collision possibilities. It is not always possible to know at the time of launch, however, whether orbital debris could pose a problem during the life of the satellite. In order to safely avoid certain large objects, some GEO satellite operators take advantage of services such as those offered by Lincoln Labs of MIT. Lincoln Labs has the capability of warning operators of geostationary systems of

²³ *Id.*

²⁴ *Id.* at ¶ 50.

orbital debris and objects that may enter the orbit of the spacecraft, allowing the operator to maneuver the spacecraft to avoid the orbital debris or object.

4. Coordination of Maneuvers.

The Commission seeks comments on what, if any, notification requirements it should adopt concerning maneuvers by FCC-licensed operators.²⁵ SIA believes that the current informal notification system works well and no Commission action is necessary. Currently, a satellite operator who wishes to undertake maneuvers coordinates with other operators (including the U.S. Space Command in appropriate circumstances) to guard against collision and interference with adjacent satellites. Although the number of operating satellites has increased dramatically over in recent years, the universe of satellite operators remains relatively small and coordination is easily accomplished. Again, in the absence of a problem, the Commission should refrain from regulating.

²⁵ *Id.* at ¶ 51.

D. Post-Mission Disposal

1. Minimum Disposal Orbit.

Removal of satellites from operational orbits is essential to minimize the possibility of collisions. U.S.-licensed satellite operators recognize this and have historically removed satellites at the end-of-life to storage orbits, which do not interfere with the launch trajectory of new satellites or the permanent orbit of existing or follow-on satellites.²⁶ As with other phases of a satellite's life, there is no existing problem with regard to de-orbiting of U.S.-licensed satellites. In the absence of a problem, the Commission should refrain from imposing any regulation.

If the Commission determines that it must adopt post-mission disposal guidelines, then SIA urges the Commission to provide flexibility to satellite operators. SIA would propose that the Commission adopt as guidelines that a minimum disposal orbit for geostationary satellites be the lower of the (i) orbit calculated by using the IADC formula or (ii) 300 kilometers. With respect to the IADC formula, the Commission should clarify that the "Area" of the satellite for purposes of calculating the "Area to mass ratio" is calculated on a deployed and on-station basis.

The disposal rules could also include, as the Commission suggests, the requirements that (i) all stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures and (ii) tracking, telemetry and control transmissions are planned so

²⁶ Operators of NGSO satellites at lower orbits have the option of deorbiting by a controlled re-entry into the earth's atmosphere. See NASA Safety Standard NSS 1740.14 (cited in *NPRM* at FN 101).

as to avoid electrical interference to other satellites, and coordinated with any potentially affected satellite networks.²⁷

Based on these guidelines, GEO licensees would have authority, as the Commission proposes, to dispose of their space stations at end-of-life in accordance with these guidelines, without specific Commission authorization.²⁸ In cases where a GEO operator determines near end-of-life that it cannot meet the guidelines, the Commission should maintain the flexibility to review that operator's proposed de-orbiting plan on a case-by-case basis.

Should de-orbit guidelines be adopted, they should be applied prospectively. The de-orbit guidelines should not apply to satellites in orbit at the time the rule is adopted. There are satellites in orbit today that have budgeted their fuel based on de-orbiting to graveyard orbits that are safely above the geostationary orbit but below the graveyard orbits proposed in the NPRM and these comments. Permitting these satellites to proceed as planned should not be problematic. Applying the requirement to existing in-orbit geostationary satellites, on the other hand, might have a significant effect on the commercial interests of the satellite operators who developed their business plans based on end-of-life assumptions that would no longer be valid. In any case, the Commission normally adopts rules that apply prospectively.²⁹

²⁷ See *NPRM* at 37.

²⁸ The guidelines, however, should not be absolute but should allow for a reasonable margin of error because fuel levels are not an exact science.

²⁹ Florida Public Service Commission Request for Interpretation of The Applicability of the Limit Charge in Interstate Allocation, *Order*, 12 FCC Rcd 3406, 3416 (1997).

With respect to NGSOs, the Commission should continue its current practice of reviewing the de-orbit plans presented by applicants on a case-by-case basis. For any type of satellite, SIA does not think it necessary for the Commission to adopt any rules regarding fuel gauging or other end-of-life plans. This is similar to mandating a specified fuel level. As noted above, it is not realistic for the Commission to set fuel levels as requirements for spacecraft differ.

2. Methodology for Analysis and Evaluation Criteria of Showings.

The Commission seeks comment on whether it should establish more detailed methodologies for preparation of showings submitted in the FCC authorization process.³⁰ It is not clear whether this question is related to disposal orbits or to other debris mitigation submissions. Regardless, SIA urges the Commission not to adopt regulatory or informational requirements that are not essential to accomplish the underlying purpose of minimizing orbital debris. SIA has shown in these comments that commercial operators have strong economic incentives to self-regulate in this area. Adopting U.S. Government guidelines is unnecessary. Streamlining, rather than imposition of additional regulation, should be the Commission's goal so long as commercial satellite operators and manufacturers have every incentive to minimize orbital debris and protect their huge capital investments.

IV. The Commission Should Not Mandate Insurance Coverage

Even if the Commission has jurisdiction to mandate insurance coverage, it should not do so for a number of reasons. First, assuming the Commission is contemplating insurance for in-orbit collisions, as has been stated repeatedly, there really is no existing

³⁰ *NPRM* at ¶ 59.

collision problem. For example, the likelihood of a satellite successfully placed in geostationary orbit reentering earth's atmosphere is zero. The Commission would be imposing an additional cost on operators and ultimately the users for little or no direct benefit.

Currently, there is limited availability of insurance resources and premiums are rising. Higher insurance rates would raise costs to customers of the satellite operators and ultimately the end user and would reduce the ability of satellite operators to compete with terrestrial operators providing similar services and foreign operators not subject to the same requirements. In the absence of an identified problem, the cost to the consumer of increased costs imposed on the operators outweighs the potential benefits to the consumer.

The only exception, should the Commission determine it is necessary, is with respect to satellites that will be de-orbited by atmospheric re-entry. There is a potential risk of damage in that situation and insurance is obtainable.³¹

³¹ See *Space System Licenses et. al.*, *Memorandum Opinion, Order and Authorization*, 17 FCC Rcd 2271, 2290 (Int'l Bur. 2002) (noting that Iridium had obtained insurance for damages caused by re-entry of satellites).

v. Debris Mitigation Rules Should Apply to All Service Providers

As a general rule, the Commission requires non-U.S. licensed satellite operators to comply with all Commission rules applicable to FCC licensees.³² To do otherwise, according to the Commission, would be to “place U.S. and foreign operators on an uneven competitive footing when providing identical satellite service in the United States.”³³ The Commission should apply this policy to any rules adopted pursuant to the *NPRM*.

Debris mitigation measures add costs to all phases of a satellite’s life –design, construction, launch and de-orbiting. If only U.S. licensees are subject to these rules, they will be at a competitive disadvantage to operators licensed by other jurisdictions.

SIA recognizes, however, that some licensing authorities may have rules in place to address orbital debris mitigation. Therefore, SIA believes the Commission should require evidence and determine on a case-by-case basis whether a foreign licensee is subject to similar and effective debris mitigation rules by another licensing authority.

³² See Amendment to the Commission’s Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Service in the United States, *Report and Order*, 12 FCC 24094, 24168 (1997).

³³ *Id.*

VI. Conclusion

The historical record shows that the Commission can depend on the self-interest of U.S.-licensed satellite operators to avoid the creation of orbital debris. Satellite operators design, operate and de-orbit their extremely costly and valuable assets -- the spacecraft -- with a view to orbital debris mitigation. There is no need for the Commission to adopt regulatory requirements in this respect. In fact, it is not at all clear that the Commission could adopt useful regulation in this area. If the Commission concludes that the benefits of some regulation outweigh the costs, it should carefully tailor the regulations to clearly identified problems.

Respectfully submitted,

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